

OCT 12 1984

*J. Ayer - info & file*  
*[Signature]*  
*10-16-84*

The Honorable Marilyn Lloyd  
Chairman, Subcommittee on Energy Research  
and Production  
Committee on Science and Technology  
United States House of Representatives  
Washington, DC 20515

Dear Madam Chairman:

In response to your letter of September 20, 1984 I am pleased to supplement the record of the July 26, 1984 hearing on the Status of the Technical Infrastructure Required to Support Domestic Food Irradiation. My response to the list of questions submitted with your letter is attached.

Sincerely,

Original Signed by  
D. R. Chapell

*[Signature]* Richard E. Cunningham, Director  
Division of Fuel Cycle and  
Material Safety

9003210149 900312  
PDR FDIA  
GILBERT90-29 PDR

Enclosure: As stated

DISTRIBUTION

RECunningham

NBassin

BSinger

JDeMedico

BClausser

CA

JGDavis

EDO - 14819

JRoe

VStello

GCunningham

FCMC r/f

NMSS r/f

FC Central File

DNussbaumer

DBMausshardt

DMorris

TRehm

GWKerr

SECY - 84-0942

*Duchs*

\*\*telephonic concurrence  
by JMapes for  
GCunningham

JLubenau\*  
for  
GWKerr  
10/10/84

EDO\*  
WJDircks  
10/10/84

ELD\*\*  
GCunningham  
10/1/84

\*See Previous Concurrence

OFFICE	FCMC	FCMC	FC	FC	OCA	NMSS	NMSS
SURNAME	NBassin*	BSinger*	DRChapell	RECunningham*	JDeMedico	DMausshardt*	JGDavis*
DATE	9/28/84	9/28/84	10/1/84	9/28/84	10/12/84	10/3/84	10/10/84

## RESPONSES TO ADDITIONAL QUESTIONS

### 1. QUESTION:

Does the chemical form of the Cesium in DOE's current capsules -- Cesium Chloride ( $\text{CsCl}$ ), which is a liquid and is also very soluble in water -- present any safety problems? How do the main safety concerns in licensing use of a Cs-137 radiation source compare to the concerns in licensing a Cobalt-60 source?

### ANSWER:

The cesium chloride ( $\text{CsCl}$ ) contained in the DOE's capsules is a solid. The main safety issues related to these capsules are potential attack by the cesium salt on capsule containment and solubility if released. The DOE has conducted corrosion examinations to confirm the adequacy of the capsule to maintain its integrity and is conducting further tests to determine the effects of thermal cyclings, as would be encountered in use of the capsules in a wet-storage, dry irradiation operation, on the capsule. If the test data demonstrate containment integrity, we believe that the capsules will be adequate for use in irradiators.

The Cobalt-60 contained in currently used capsules is in the form of solid metal seeds which are only slightly soluble in water. The Cobalt-60 capsules have been used several years in irradiators and have a good record of integrity.

Regardless of capsule integrity, backup systems are required to detect leakage. Due to the very high solubility of  $\text{CsCl}$  compared to metallic Cobalt-60, special procedures are contemplated to manage leakage in the unlikely event that it occurs.

The safety considerations for operation of an irradiator containing either Cesium-137 or Cobalt-60 are the same.

### 2. QUESTION:

Would it not be prudent from a safety concern to require the same standards for maintaining an operating license for a cobalt wet storage irradiator?

### ANSWER:

Once the integrity and adequacy of the capsules used in an irradiator have been demonstrated, the safety considerations are essentially the same for irradiators containing either cesium chloride or cobalt metal in the capsules. As noted above, the management of  $\text{CsCl}$  leakage in the event that it occurs requires some additional precautionary procedures due to its solubility.

3. QUESTION:

What manner of waste disposal is currently required for large radiation sources? Do you have an idea of what the cost of disposal is (or might be) on a cost per curie of radiation basis? What process does the NRC use to assure that radiation sources will be disposed of properly?

ANSWER:

Most of the large irradiators in the United States use Cobalt-60 sources purchased from Atomic Energy Canada Limited (AECL). Under present arrangements, most of these sources are replaced and the spent sources are reclaimed by AECL. Cesium chloride sources in the form of WESF capsules are supplied by DOE. DOE has stated that it will take back spent capsules for storage. Requirements for disposal of waste by an individual licensee are set forth in the Commission's regulation 10 CFR Part 20, "Standards for Protection Against Radiation," for sources of the type used in irradiators. The regulation permits transfer only to persons specifically licensed to possess the sources such as operators of commercial land burial facilities. The operations of a commercial waste burial ground are governed by the Commission's Regulation 10 CFR Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste," or equivalent regulations by an Agreement State.

Charges by commercial land burial facilities for disposal of wastes are based on package volume and the extent of special handling. For waste of low activity current charges at burial grounds range from \$17.00 to \$30.00 per cubic foot of package volume. Based on our discussions with a burial ground operator, the cost of disposal of very large sources (about 30,000 Ci) could be as high as \$3000 per cubic foot of package volume.

4. QUESTION:

Does the NRC know the current location and condition of all radiation sources that are in the United States? What about sources fabricated in the United States and exported to other countries? Are you confident that the situation that recently occurred in Mexico -- where a cobalt radiation source was relegated to a junkyard and wound up exposing numerous individuals to excessive radiation levels -- was a fluke and is not likely to happen again? Has the NRC taken any actions that could prevent another such occurrence?



ANSWER:

The specific licenses issued by the NRC specify the radiation sources which may be possessed by licensees and specify the location at which the sources may be used. Specific licensees who distribute radiation sources to general licensees are required to report the name and location of persons to whom the sources are sent. Although the NRC does not know the condition of radiation sources at any given time, licenses which provide for possession and use of the sources require periodic leak testing of them. If there is any leakage of radioactive material from a source, the licensee is required to report the leakage to the NRC and take immediate steps to correct the problem. The NRC conducts periodic inspections of persons licensed to possess radiation sources to determine if the licensee's program is in compliance with NRC regulations and the terms and conditions of the licenses.

With respect to radiation sources fabricated in the United States and exported to the other countries, the NRC does not have knowledge of the location and condition of the sources. The NRC staff is analyzing the issues related to notification of foreign governments of the export of radioactive sources to persons in foreign countries.

Although we believe the incident which occurred in Mexico to be a unique situation, the following actions are being taken to minimize other occurrence or the effects of such an occurrence.

1. A study under contract with Aerospace Corporation has been initiated to assess the feasibility of detecting unauthorized radioactive material accidentally contained in items that enter the United States through commercial import channels.
2. Radiation detection instruments have been provided to each of the 22 U.S. Customs port of entry locations along the U.S./Mexico border and Customs agents have been instructed in the use of the instruments.
3. The NRC is developing plans to provide prompt response to incidents such as the Mexican incident. The response plan will incorporate interactions with other Federal agencies and State governments.

## RESPONSES TO MINORITY QUESTIONS

### 1. QUESTION:

What amount of effort is necessary to reach an agreement with a state relative to material irradiation? How soon do you think the remaining 23 states will reach such agreement with NRC?

### ANSWER:

Section 274 of the Atomic Energy Act, as amended, provides a mechanism which permits states to assert regulatory authority over certain categories of radioactive materials - byproduct materials (radioisotopes), source materials (the raw materials of Atomic Energy) and small quantities of special nuclear material. Irradiators typically use byproduct materials. The criteria that states wishing to enter into such agreements must meet are provided in a Commission Policy Statement published in the Federal Register (46 FR 7540, January 23, 1981; 46 FR 36969, July 16, 1981; and 48 FR 33376, July 21, 1983). After an agreement is signed, the Act requires periodic reviews by NRC of Agreement States programs. Guidelines for this purpose have been issued by the Commission as a Policy Statement (see 46 FR 59341, December 4, 1981).

The amount of effort needed to enter into an agreement is a function of several variables including the scope of the proposed agreement, the number of NRC licenses that will be transferred to the state and the amount of preparatory work that is needed. Preparatory work includes drafting and enactment of enabling legislation, recruitment and training of staff to carry out the program, drafting and promulgation of regulations, and development of administrative and technical procedures. Supporting documentation for the Governor's request for the agreement showing that the program will meet the criteria must also be prepared. Typically, once a decision is made to seek status as an Agreement State, preparations for an agreement take one to two years.

Whether or not a state seeks an agreement is a matter of choice for the state. At the present time, NRC is negotiating agreements with Iowa and Illinois. Pennsylvania is actively working toward an agreement. While timeframes have not been firmly set, we believe that agreements with Iowa and Illinois are possible by late 1985 or early 1986. Other states are presently examining the possibility of entering into an agreement; these include Virginia, Massachusetts and Wisconsin.

2. QUESTION:

In your experience, what is the public perception of food irradiation?

ANSWER:

We have not dealt with the general public on the matter of food irradiation. The Public Health Service, Department of Health and Human Services, published a proposal in the Federal Register on February 14, 1984, on the use of radiation sources for the treating of food and is analyzing public response on this issue.

3. QUESTION:

If the individual states are the irradiation regulators, what role do you anticipate for NRC relative to that technology in the future?

ANSWER:

Irradiators are licensed by both the NRC and the Agreement States. The NRC has offered to provide technical assistance to Agreement States in the review of applications for large irradiators. The NRC has dealt directly with the Department of Energy on the matter of the use of the DOE Cesium-137 capsules in irradiators. The regulatory position developed by the NRC, on the basis of DOE experience and our licensing practices, is provided to the Agreement States for their adoption.

For future technology, which might be licensed by an Agreement State, we anticipate analyzing the technology for safety considerations and providing guidance as might be appropriate.





Department of Energy  
Washington, D.C. 20545

JUL 25 1984

Mr. Richard E. Cunningham, Director  
Division of Fuel Cycle and Material Safety  
U.S. Nuclear Regulatory Commission  
Silver Spring, MD

Dear Mr. Cunningham:

As agreed in our July 10, 1984, meeting regarding the Nuclear Regulatory Commission's (NRC) licensing of the cesium 137 Waste Immobilization and Storage Facility (WESF) capsule in irradiators, please find enclosed the June 1984 report PNL-5170, "A Review of Safety Issues That Pertain to the Use of WESF Cesium Chloride Capsules in an Irradiator," which this office is submitting in support of our licensing request.

As discussed, the Department of Energy (DOE) believes that the test data collected to date, especially that from the 6 years operating experience with the Sandia Irradiator for Dry Sewage Solids, should furnish ample evidence that an NRC license for similar irradiators utilizing wet load, dry storage, and dry operation design concept is warranted.

With respect to wet load and storage and dry operation irradiators, we believe that considerable technical information exists from 10 years operation of WESF that are applicable to the licensing process. In addition, we have begun an accelerated thermal cycling tests of two WESF capsules. This evaluation should be completed in 6 months. DOE recommends that NRC license the first wet/dry facility on the basis that:

(1) a capsule would be removed annually from one of each type of irradiator and subjected to destructive evaluation to confirm that operation of these facilities does not result in conditions beyond those that have previously demonstrated a high degree of integrity of the thick-walled, doubly-encapsulated WESF cesium capsules;

(2) irradiator operating limits be established well within demonstrated integrity limits, e.g.,

wet load, dry storage,  
dry operation irradiator

operating/storage temperature  
limit:  $\leq 300^{\circ}\text{C}$

wet load, wet storage,  
dry operation irradiator

operating surface temperature  
limit:  $\leq 300^{\circ}\text{C}$

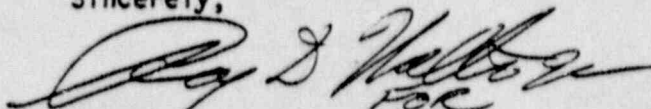
thermal cycle limit:  
12,000 cycles air to water  
200°C maximum  $\Delta T$

8504240242 2pp

A164

I appreciate the opportunity that we had on July 10, 1984, to discuss with you and your staff the safety issues and related data. If you have any questions, please contact me accordingly.

Sincerely,

A handwritten signature in dark ink, appearing to read "John J. Jicha, Jr.", with a stylized flourish at the end.

John J. Jicha, Jr., Director  
R&D and Byproducts Division  
Office of Defense Waste  
and Byproducts Management

Enclosure



\*

NOTES ON MEETING W/DOE PERSONNEL 10 JULY 1984

ATTENDING:

BILL Mc MULLEN, ALBUQUERQUE OPERATIONS OFFICE

GARTH TINGEY, BATTELLE NORTHWEST

BILL REMINI, DOE HEADQUARTERS

JOHN JICHA, " "

DICK CUNNINGHAM, NMSS: NRC

NATE BASSIO, " "

JIM AYER " "

I. WESF CAPSULE TESTING

A. DOE'S PROGRAM FOR, AND RESULTS OF:

1. COMPATABILITY TESTING

a. LONG-TERM CORROSION TESTING WAS DISCUSSED BY GARTH TINGEY

2. THERMAL CYCLING WAS DISCUSSED BY BILL McMULLEN. TESTING DOES NOT INCLUDE DETERMINING BY TEST THE COMBINED EFFECTS OF THERMAL CYCLING AND CORROSION. ONLY THE OUTER CAPSULE WILL BE STUDIED @ 4400 CYCLES OBTAINED OVER A PERIOD OF ~ 6 MONTHS (2 CAPSULES). SEE FIGURES.

• GARTH TINGEY OFFERED THAT PERHAPS ENOUGH INFORMATION EXISTED, OR WAS BEING OBTAINED, TO DERIVE A TEMPERATURE - CORROSION RATE RELATIONSHIP.

3. JIM AYER INFORMED THAT THE NRC WOULD LIKE TO SEE THE THERMAL CYCLING EFFECT ON CORROSION RATE TREATED.

A DISCUSSION TO NO CONCLUSION FOLLOWED.

4. BILL Mc MULLEN DISCUSSED SWELLING CHARACTERISTICS - SOME EXPERIMENTS AND A MATHEMATICAL ANALYSIS WERE DONE. THE RESULTS WERE USED TO SCREEN OUT HEAVILY-LOADED CAPSULES FOR REENCAPSULATION AT ORNL. A/b5

18. JOHN JICHA WILL PROVIDE DOE VIEWS ON ACCEPTABLE CAPSULE BEHAVIOR AND CONDITIONS FOR USE IN A LETTER TO BE WRITTEN IN THE NEXT WEEK.

## II. DEMONSTRATION FACILITIES

A. DOE'S PROGRAM IS AIMED AT COMMODITIES TREATMENT AND PUBLIC ACCEPTABILITY, ACCORDING TO JOHN JICHA, AND NOT AT CAPSULE PERFORMANCE, FOR WET STORAGE / DRY IRRADIATION.

- JIM AYER ALLOWED THAT NRC MAY REQUIRE SAMPLING AND EXAMINATION OF CAPSULES TO MONITOR PERFORMANCE.

DOE SEEMED LUKEWARM TO THIS IDEA; BILL REMINI PLEADED BUDGET UNCERTAINTIES; JOHN JICHA ALLOWED THAT DOE HAS A LONG-TERM COMMITMENT HERE AND THAT FOR THIS PURPOSE FUNDING MAY BE DEDICATED.

1. SIDSS - BILL McMULLEN INDICATED THAT CORROSION STUDY RESULTS AND SIDSS OPERATION MAY INDICATE THAT, FOR DRY STORAGE / DRY IRRADIATION, VENTILATION RATES SHOULD BE SUCH THAT OUTER CAPSULE WALL TEMPERATURE BE MAINTAINED BELOW 100°C. HE FURTHER SAID THAT HE FELT ENOUGH TESTING DATA AND OPERATING EXPERIENCE EXISTED TO YIELD HIGH CONFIDENCE IN THE SIDSS AS A SUCCESSFUL DEMONSTRATION OF THE DRY STORAGE / DRY IRRADIATION MODE.

2. CACS - THE DEMONSTRATION OF AGRICULTURAL COMMODITIES IRRADIATION HAS JUST ENTERED THE DESIGN / CONSTRUCTION PHASES. THIS PROJECT USES THE DRY IRRADIATION / WET STORAGE MODE OF OPERATION. GARTH TINGEY OFFERED THAT, BASED ON ANALYTICAL WORK, LITTLE OR NO STRESS WAS EXPECTED DUE TO THERMAL CYCLING OF WET CAPSULES.

- BILL Mc MULLEN VENTURED THAT HE FELT NOT ENOUGH DATA OR EXPERIENCE EXISTED TO BUILD CONFIDENCE IN THE LONG-TERM PERFORMANCE OF WEST CAPSULES IN THE DRY IRRADIATION / WET STORAGE MODE. JIM HYER AGAIN STATED THAT NRC/NMSS WOULD LIKE TO SEE EXPERIMENTS AND ANALYSIS THAT ADDRESSED THE COMBINED EFFECTS OF CORROSION AND THERMAL CYCLING (FATIGUE).

B. JOHN SICHA WILL PROVIDE DOE VIEWS ON ACCEPTABLE PERFORMANCE OF DEMONSTRATION FACILITIES.

### III. WEST CAPSULE ALLOCATION

B. JOHN SICHA / BILL Mc MULLEN SAID THAT ORDERS FOR USCL IN WEST CAPSULES HAD BEEN RECEIVED AS FOLLOWS:

JOTECH	12 MCi
RADIATION STERILIZERS	40 MCi
RADIATION TECHNOLOGY	15 MCi
CER	0.25 MCi
AECL	20 MCi
TOTAL	87.25 MCi

AND THAT DOE INTENDED TO RESERVE 20 MCi FOR EXPERIMENTATION, DEMONSTRATION, ETC. <sup>PRESENT</sup> THE ORDERS AND RESERVE CREATED A SHORTFALL OF ABOUT 30 MCi. DOE'S SOLUTION WOULD BE TO NOT FILL THE ORDER FROM AECL AND PROVIDE RADIATION STERILIZERS WITH 30 MCi INSTEAD OF THE 40 MCi ORDERED. JOHN SICHA ALSO STATED THAT THE \$0.10 / Ci OFFER FOR USCL WOULD BE WITHDRAWN AS OF 20 JULY 1984. HE INTENDS TO SEND A LETTER TO COMMERCIAL USERS



TO DETERMINE THEIR INTEREST IN CSCL AT \$1.00/LB. ON THE SUBJECT OF FUTURE AVAILABILITY ~ 40 MC: IS AVAILABLE AT HANFORD AND ANOTHER 100 MC: AT SAVANNAH RIVER. THERE IS NO CONVERSION FACILITY AT SAVANNAH RIVER SO TRANSPORT TO HANFORD IS A POSSIBILITY BEING STUDIED. THE TIMETABLE FOR CONVERSION OF AVAILABLE CSCL WAS PROPOSED AS 1987-88 FOR HANFORD-STORED MATERIAL AND 1990 FOR MATERIAL STORED IN SAVANNAH RIVER.

IV. DIRECTION OF FUTURE EFFORT - JOHN JICHA WILL PROVIDE DOE'S VIEWS IN A LETTER TO BE WRITTEN IN THE NEXT WEEK.

PNC 18-20 JULY 1984

ADD JEA TO DISTN OF TESTING REPORTS ON WEF CAPSULES

SANDIA 23-24 JULY 1984

10 JULY

BILL Mc MULLEN 846-5236

GARTH TINGEY 375-2419

BILL REMINI

JOHN JICHA

NATE BASSIN

DICK CUNNINGHAM

JIM AYER

III.

10¢/Ci → \$1.00/Ci ON FUTURE (PURIFIED) CsCl (J.J.)

LETTER TO THAT EFFECT IN JULY '84

40 MCi HANFORD, REDESIGN OF ENCAPSULATION.

WEAPONS PRODUCTION PRIORITIES PRECLUDE GO PRODUCTION.

~

REQUESTED

COULD DELIVER

10TECH 12 MCi

12 MCi

RADIATION STERILIZERS 40 MCi

~ 30 MCi

RADIATION TECHNOLOGY 15 MCi

15 MCi

AECL

20 MCi

DOE

20 MCi

SHORTAGE

30 MCi

Φ  
20 MCi

AVAILABLE

~ 77 MCi

BUSS CASE TO NRC EARLY '85 COULD HANDLE 1 MCi  
BY SANDIA TTT

100 MCi SAVANNAH RIVER '87-'88

1 MO/yr CSCI FROM IDAHO COP.

STATUS OF GETE FOR CO IRRADIATION ?

- ✓ GEOLOGICAL CONDITIONS (TEMPERATURE) DO NOT REFLECT CONDITIONS THAT MAY OCCUR IN COMMERCIAL USE. HIGH RATES OF VENTILATION MAY BE REQUIRED.

SIDSS CAPSULES 3 YRS. IN USE, 4 YRS IN POOL PREVIOUSLY.  
27 MO. IN AIR. 0.0003 MMH CORROSION.

- ✓ THERMAL CYCLING FOR 4400 CYCLES<sup>IN</sup> - 6 MO.

EXAMINATION

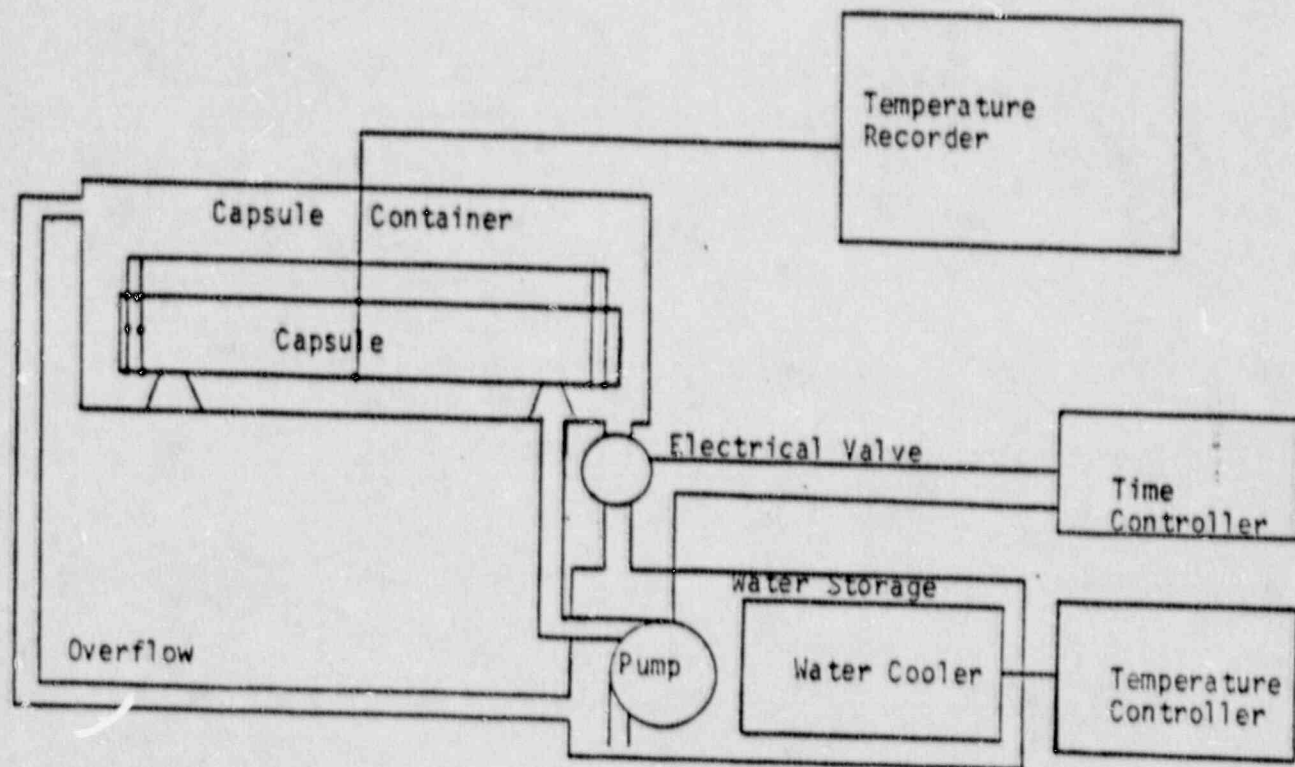
- ✓ CACI DEMONSTRATION AIMED AT COMMODITIES TREATMENT & PUBLIC ACCEPTABILITY, NOT AT CAPSULE PERFORMANCE. NRC MAY REQUIRE SAMPLING & EXAMINATION OF CAPSULES TO MONITOR PERFORMANCE.

~~II~~

JOHN NICHAS WILL GIVE IB, IIB, & IV IN LATER CORRESPONDENCE.

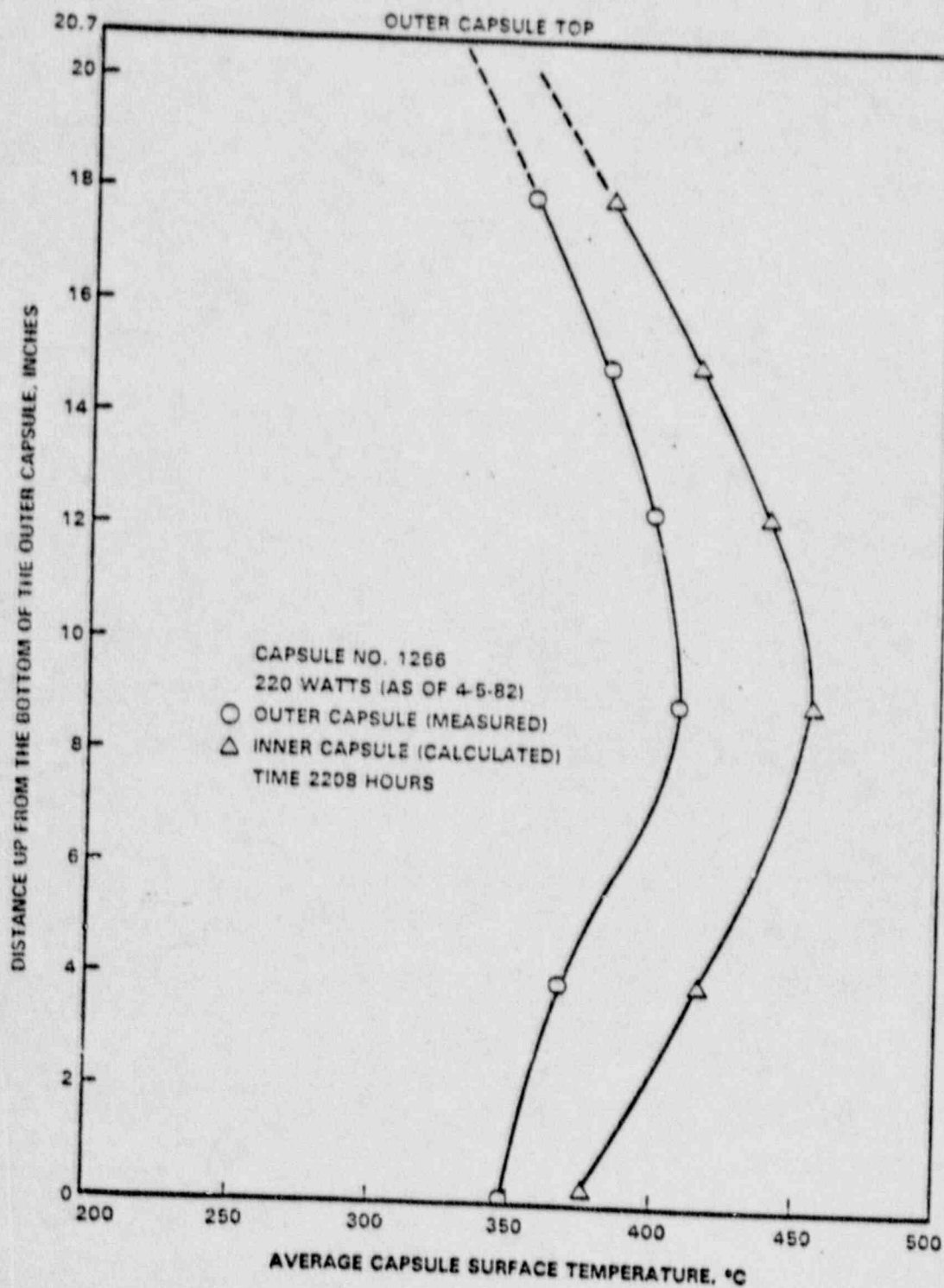


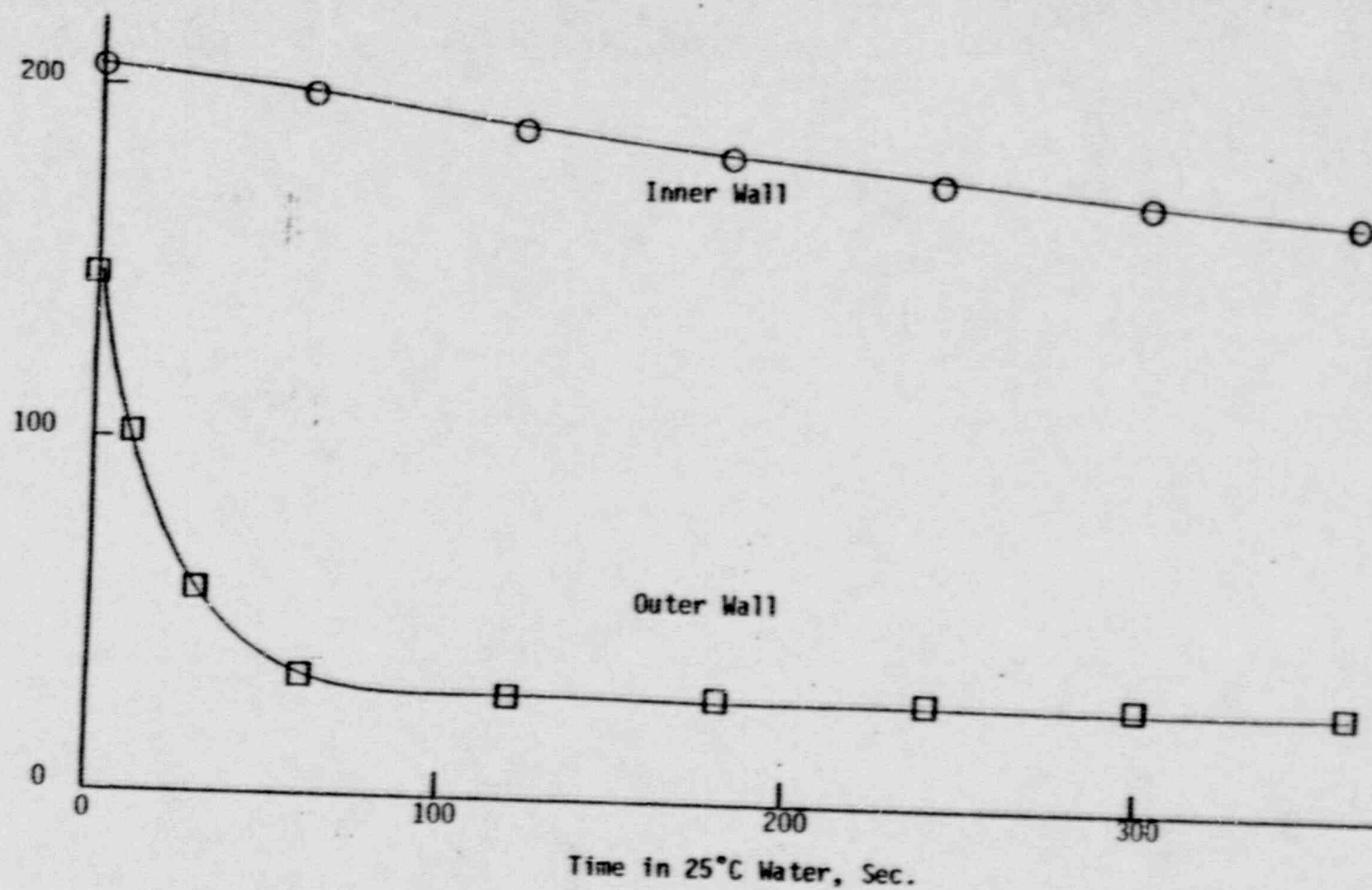
# THERMAL CYCLING TEST EQUIPMENT



- Thermal cycling is accomplished by pumping water in and draining water out of the capsule container at a specified schedule.
- The overflow permits continuously cycling cool water from the sump to the capsule container during capsule cooling, facilitating a constant temperature bath and/or a more turbulent cooling cycle.

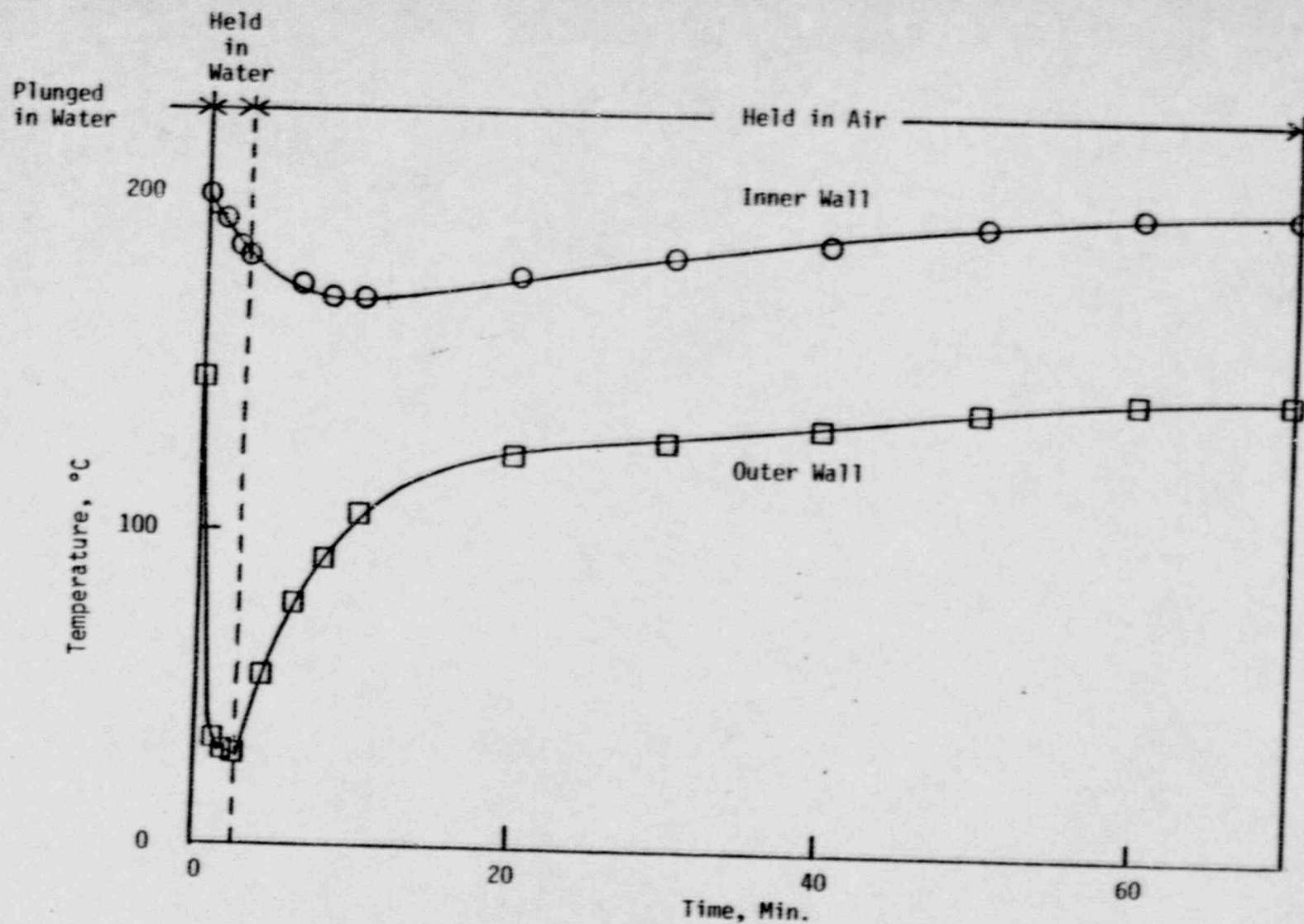
AVERAGE TEMPERATURE PROFILES FOR A WESF CAPSULE INSULATED IN A SILICATE TUBE  
WITH A 1.5-INCH WALL AND 3-INCH TOP AND BOTTOM



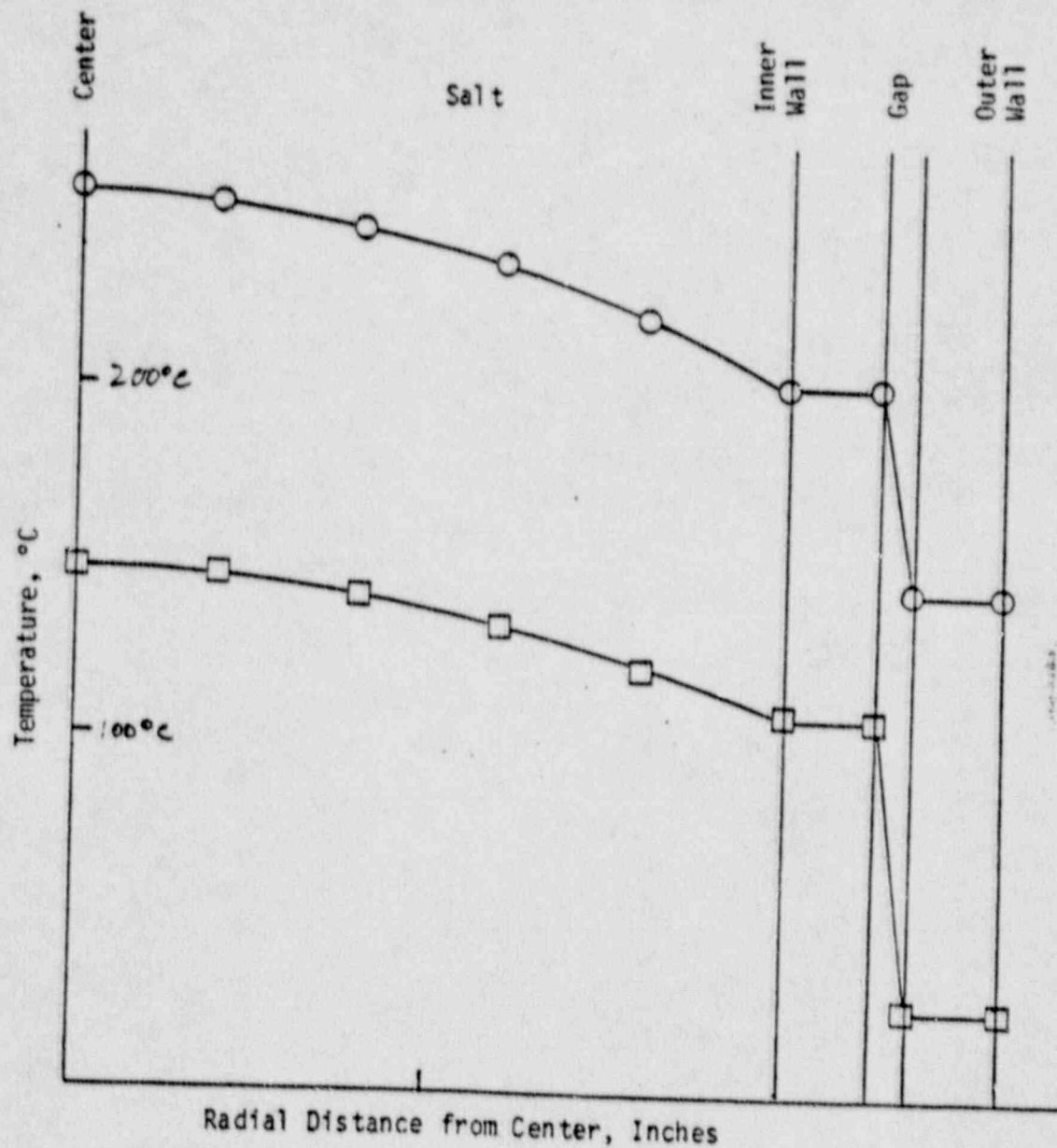


Calculated Temperature Versus Time for a 75 kCi WESF Cesium Chloride Capsule Initially at Equilibrium in 25°C Air, Then Suddenly Plunged into 25°C Water





Calculated Temperature Versus Time for a 75 kCi WESF Capsule Initially in Equilibrium in 25°C Air, Then Suddenly Plunged into 25°C Water and Held for 150 Sec, Then Held in Air Again



Calculated Temperature at Mid-length Versus Radial Distance from the Center of 75 kCi WESF Cesium Chloride Capsule at Equilibrium. ○ - capsule in 25°C air; □ - capsule in 25°C water. The inner and outer capsules are assumed to be concentric.

# DOE DEMONSTRATION FACILITIES

1. SIDSS (Wet Load/Dry Operate)
  - Intermittent Operation Since 1978
  - MCI Cs-137 (15 WESF Capsules)
2. Transportable Cesium Irradiator (TRCI)  
(Dry Load/Dry Operate)
  - License Application to NRC 1st Qtr. FY85
  - Operational 2nd Qtr. FY85
  - 250 KCI Cs-137 (4 WESF Capsules)
3. Cesium Agricultural Commodities Irradiator (CACI)  
(Wet Load/Wet Operate)
  - License Application to NRC 2nd Qtr. FY85
  - Operational 1st Qtr. FY86
  - 3 MCI Cs-137 (50 WESF Capsules)
4. Fresh Pork Irradiator
  - Concept Undetermined
  - Site Selection 1st Qtr. FY85
  - 2-3 MCI Cs-137
5. Albuquerque Sewage Sludge Irradiator  
(Wet Load/Dry Operate)
  - 12-15 MCI Cs-137
  - Status Uncertain
6. Related Commercial Irradiators
  - Using Cs-137 for Medical Products Sterilization